

## Lec : 2

### \* First Part : Machine Learning.

#### definition.

- Arthur Samuel (1959)

machine learning: Field of study that gives computers the ability to learn without being <sup>واضح</sup> explicitly programmed.

② راسه تعطى القدره للكمبيوتر على التعلم من خلال التدريب والا اختبار بدون أن يكون ذلك عبارة عن برمجة مباشرة

- Tom Mitchell (1998)

Well-posed learning Problem: A computer program is said to learn from experience  $E$  with respect to some task  $T$  and some performance measure  $P$ , if its performance on  $T$ , as measured by  $P$  improves with experience  $E$ .

example for Tom definition: Checkers game

A machine has been designed to play this game. This machine trained to play with itself many times so there is must be a winner so the machine learned to play

→ Task : machine plays this game

→ Experience : machine plays with itself many times

→ <sup>أداء</sup> Performance : machine win

✓ When a machine plays with human it get its experience from him  
✓ The Idea of machine learning is to design a machine train to learn anything by itself. So in this game (Checkers) we give it tools to play but no training. The machine played with itself many times. During playing, it save every thing (good OR bad) so after many times it can know the best way to play. Here we can say that the experience is "the machine plays with itself" as it get this experience from playing with itself. It get experience to do a Task which is the ability of the machine to play this game.  
The performance is the ability of the machine to win so it (P) is very Important to know the machine efficiency.  $\omega$

Another Example:

machine learning problem to determine whether the e-mail is spam or not depending on (user make any e-mail without known source is spam OR any other case)

Task : Classifying the e-mails is spam or not spam.

Experience: Watching you label e-mails spam or not spam.

Performance: The number of e-mails is correctly classified

Examples :

- Database mining
- Applications can't program by hand
- Self-customizing programs.
- Understanding human learning (brain, real AI)

Machine learning Algorithms :

- Supervised learning (labeled data)
- Unsupervised learning (unlabeled data)
- Reinforcement learning
- recommender systems.

## 1. Supervised Learning

• Labeled Data

We give the machine steps (Input) and the right answers.

Supervised learning  
types

Regression

Classification

Continuous Valued  
Output

Discrete Valued  
Output  
(0 or 1)



## Best Fitting

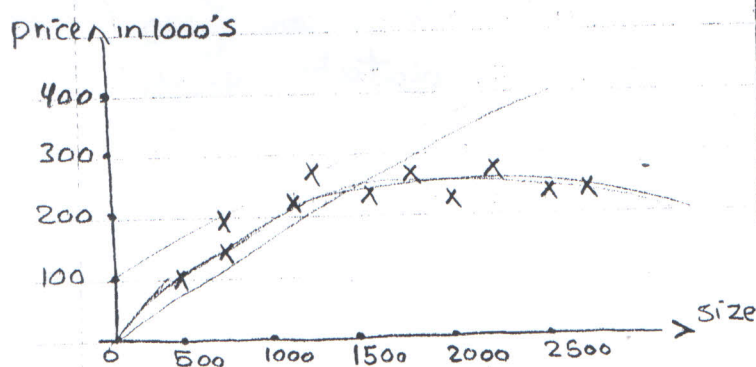
### Regression Supervised

Continuous valued output

## Example.

### Housing price prediction

- given houses size in Feet<sup>2</sup> (input)
- given houses price (right answer)



- If we want to know the price of house with known size, we can make a model to get the best way to do this task

- a. we use a straight line passing most of points (the start of this line can create many lines)
  - b. we use a curve passing most of points
- This models (straight line & curve) can be good or bad for getting the best or the exact price of the house with known size.

## Decision Boundary

### Classification Supervised.

Discrete valued output (0, 1)

### Breast Cancer

• Tumor Size (input) given

- 1: Malignant مريض
- 0: Benign سليم

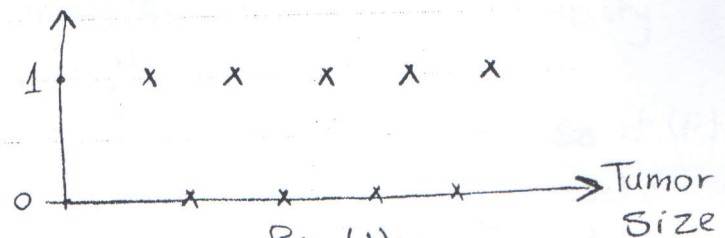


Fig (1)

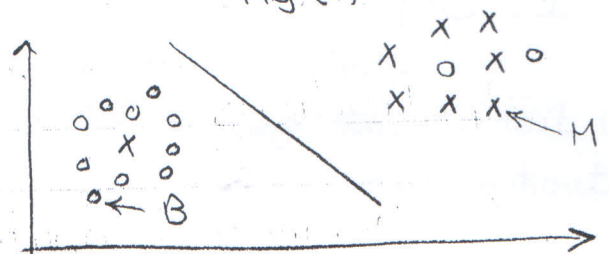


Fig (2)

- In another examples there is more than 2 Features.
- We can use Fig (2) to know the performance range of this method by another meaning if its perf. is 90% and we have a patient we can use this method. its answer can be correct in 90%

Solution of Slide 11 is : 3

## 2. UnSupervised Learning.

- UnLabeled Data.

- The machine hasn't have the right answer.

- The machine Collect the Similar Inputs together and Create groups. OR divides inputs into groups depending on Simple mathematical equation.

This mathematical equation depends on the distance between the inputs. Clustering algorithm.

IF it has 2 groups of points, it make a Center point and measures the distance between the Center point and all the other points and Collect the near ones together. This algorithm can be Considered as the most famous method.

ex: Genes (using Colours)

### Applications

1. Organize Computing Clusters.

2. Social network analysis.

3. Market Segmentation.

4. Astronomical data analysis

→ Answer of Slide 21

- Supervised (Classification)

- Unsupervised

- UnSupervised

- Supervised (Classification)